

Advanced Carbothermal Electric Reactor, Phase II

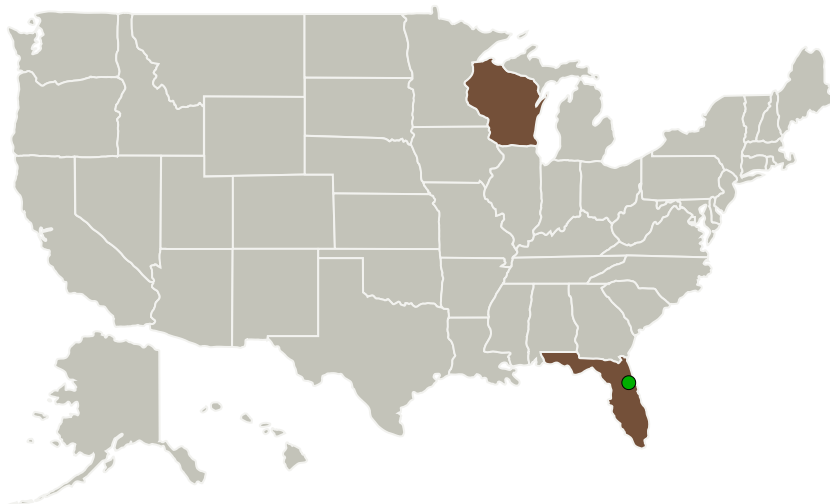
Completed Technology Project (2011 - 2013)



Project Introduction

The overall objective of the Phase 1 effort was to demonstrate the technical feasibility of the Advanced Carbothermal Electric (ACE) Reactor concept. Unlike state-of-the-art carbothermal reactors that use concentrated solar energy and/or laser energy to heat the regolith, the ACE Reactor uses an innovative method to electrically heat the regolith to temperatures over 1800°C within a thermally insulated environment, either with or without a crucible. Commercial high-temperature heating elements made from molybdenum disilicide (MoSi₂) are designed to only operate in oxidizing atmospheres where a protective layer of silicon dioxide (SiO₂) will form. In Phase 1, the ACE reactor used MoSi₂ heating elements with a protective coating to allow them to operate in any type of environment (oxidizing, reducing, or vacuum). The ACE Reactor concept eliminates the problems encountered with traditional carbothermal hot-wall reactors and offers significant advantages over current carbothermal reactor approaches. By eliminating the need for a concentrated solar energy system, the ACE reactor offers a significantly lowers system mass and removes the need to keep optical surfaces clean. In addition to efficiently producing oxygen, the ACE reactor separates the processed regolith into metallic iron and a silicate glass that can be formed into structural components or shielding materials.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
Sierra Nevada Corporation(SNC)	Lead Organization	Industry Women-Owned Small Business (WOSB)	Sparks, Nevada
● Kennedy Space Center(KSC)	Supporting Organization	NASA Center	Kennedy Space Center, Florida
Orbital Technologies Corporation	Supporting Organization	Industry Women-Owned Small Business (WOSB)	Madison, Wisconsin

Primary U.S. Work Locations

Florida	Wisconsin
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Project Transitions

▶ **June 2011:** Project Start

✓ **November 2013:** Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/138664>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Sierra Nevada Corporation (SNC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Robert J Gustafson

Co-Investigator:

Robert Gustafson

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Technology Maturity (TRL)

Start: **4**
Current: **5**
Estimated End: **5**



Technology Areas

Primary:

- TX07 Exploration Destination Systems
 - └ TX07.1 In-Situ Resource Utilization
 - └ TX07.1.3 Resource Processing for Production of Mission Consumables

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System